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A Bayesian analysis of the parasitic ecology in *Jenynsia multidentata* (Pisces: Anablepidae)

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ABSTRACT. *Jenynsia multidentata* Jenyns, 1842 (one-sided livebearers) are euryhaline viviparous fish of small size, used in the laboratory experiment, important as resource for biological control of mosquito's larva and a key species to recover eutrophic lakes. Works have been published dealing with parasite biodiversity of this host, but little has been studied about the parasite community ecology. From early 2009 to ends of 2010 specimens of *J. multidentata* were collected from two places, the Salado Relief Channel (S.R.C.) on Samborombón Bay and the Sauce Chico River near to the city of Bahia Blanca (B.B.). All fish were sexed, measured and grouped into sizes/age classes. The fishes from both sites harbored 16 parasitic species: nine digenean, one monogenean, one metacestode, one acanthocephalan, two nematode and two copepods. *Lecithaster confusus* Odhner, 1905, the metacercariae Hemiuridae gen. sp. indet., metacercariae *Thylodelphys* sp. (inside the eye), *Glossocercus* sp. nematode L4 (intestine) and *Ergasilus sieboldii* Nordmann, 1832 are new records for the host. The high number of larval stages made of this fish a link between micro and macroecosystems. The size 2 had the higher biodiversity in both sites, which could be the most suitable age to store the maximal number of parasite of the environment and have a more equitability in their distribution on the host. In B.B. some parasites had higher prevalence and mean abun dance due to the small size of the waterbody compared with the S.R.C. Despite that, in S.R.C. exist a higher specific richness and biodiversity due the daily flow of saline and freshwater and proximity of the sample site to the mouth of the channel in the bay. This is the first approximation to an analysis of the parasitic ecology on this host.

KEYWORDS. Diversity, Samborombon Bay, Bahia Blanca, Salado River Relief Channel, Low Sauce River.

RESUMEN. Un análisis bayesiano de la ecologia parasitaria em *Jenynsia multidentata* (Pisces: Anablepidae). *Jenynsia multidentata* Jenyns, 1842 (madrecitas) son peces viviparous, eurihalinos de pequeño tamaño usados en experimientos de laboratorio, como un recurso importante para el control biológico de larvas de mosquito y una especie clave para recuperar lagos eutrofizados. Han sido publicados varios trabajos acerca de la biodiversidad parasitaria de este pez pero poco es conocido acerca de la ecologia de la comunidad parasitaria de este hospedador. pero poco se conoce acerca de su ecología parasitaria. Durante los meses de primavera y verano en el 2009 y 2010, especímenes de *J. multidentata* se colectaron del Canal Colector del Salado (S.R.C.) en la Bahía de Samborombón y del Rio Sauce Chico cercano a la ciudad de Bahía Blanca (B.B.), fueron sexados, medidos y agrupados en clases según su tamaño/edad. Los peces de los dos sitios albergaron 16 especies de parásitos: nueve digeneos, un monogeneo, un cestodo, un acantocéfalo, dos nematodos y dos copépodos. *Lecithaster confusus* Odhner, 1905, la metacercaria Hemiuridae gen. sp. indet., metacercaria *Thylodelphys* sp. (en el ojo), *Glossocercus* sp. nematode L4 (intestino) y de *Ergasilus sieboldii* Nordmann, 1832 son nuevas citas para el hospedador. El gran número de estadios larvales hacen de este pez un nexo entre micro y macroecosistemas. La talla 2 tuvo una mayor biodiversidad en ambos sitios, la cual puede ser la edad más apropiada para recolectar el máximo número de parásitos del ambiente y tener una distribución dentro del hospedador de mayor equitabilidad. En B.B. algunos parasitos tuvieron mayor prevalencia y abundancia media debido al menor tamaño del cuerpo de agua comparado con S.R.C. A pesar de esto, en S.R.C. existe una mayor riqueza específica y biodiversidad debido al flujo diario de agua dulce y salina y a la proximidad del sitio de muestreo a la desembocadura del canal en la Bahía. El gran número de parásitos en los machos puede deberse a un cambio en el uso de la energía que se focaliza en la reproducción. Esta es la primera aproximación a un análisis de la ecología parasitaria de este hospedador y, como resultado, podemos ver algún tipo de influencia del mismo que no debe ser ignorado y debería ser estudiado en el futuro considerando cada parasito como la interrelación entre ellos y el hospedador.

PALABRAS-CLAVE. Diversidad, Bahía de Samborombon, Bahía Blanca, Canal Colector del Río Salado, Río Sauce Chico.

Jenynsia multidentata Jenyns, 1842 is a eurihaline fish of small size and viviparous (Siccardi, 1940; Menni *et al.*, 1996; Betito, 2006). These fishes feed of micro and meso animals (Ringuelet *et al.*, 1967; Ringuelet, 1975; Escalante, 1987) and represent a link between zooplankton and birds or bigger fishes. The great power of adaptation, reproduction and feed habits of the viviparous fish *J. multidentata* (known as "one-sided livebearers") makes this species an useful resource as biological control of mosquitoes larvae (Marti *et al.*, 2006), experimentation fish in the laboratory (for example, Valdes *et al.*, 2016) and a key species to recover eutrophic lakes (Iglesias *et al.*, 2008).

The role played by this fish in the food chain is important in the lifecycle of the parasites because a large number of larvae are hosted. In Argentina parasites hosted by *J. multidentata* was studied mainly by Ostrowski de Nuñez (1974, 1976, 1992, 1993, 1998, 2001) and Szidat (1969). This fish also host the acanthocephalan *Wolffughelia* *matercula* Mañé-Garzón & Dei-Cas, 1974 found in Argentina by Lunaschi & Drago (1995). Moreno *et al*. (1986) report *Lernaea cyprinacea* (Linnaeus, 1758) parasitizing one-sided livebearers. Only Romero (2005) in her grade-thesis made an approach to the ecological research of the community ecology of this important fish.

The main objective of this manuscript is to compare the parasitological fauna of *J. multidentata* with Bayesian statistics in two estuarine environments from Argentina.

MATERIALS AND METHODS

Among the months of spring and summer of 2009 and 2010, 377 specimens of *J. multidentata* (one-sided livebearers) were collected from the Salado Relief Channel (S.R.C) on Samborombón Bay (35°57'S; 57°25'W) and the Sauce Chico River (B.B.) (Fig. 1), close to the locality of Coronel Cerri in the Bahia Blanca estuary (39°11'S; 62°03'W). The S.R.C. located in the north of the Samborombón Bay is a wide channel connected with the Salado river near its mouth in the Bay.

The sample site is near the mouth over the Rio de La Plata river and is influenced by the winds and the marine tide. In this site it is possible to capture marine organisms like jellyfish and marine fish, or typical freshwater animals like catfish. The Sauce Chico River is a slender and shallow river which flows into the Bahia Blanca estuary. The sample site is far from the mouth. In this river was sampled characid fishes, characteristic of freshwaters from the continent (the salinity was not measured).

The specimens of *J. multidentata* were transported to the lab in bags with water of the sampling site and added oxygen. In the laboratory, they were maintained in aquariums until the parasitological examination. The one-sided livebearers were euthanized with the lower possible pain, measured in their standard length (SL) and total length (TL), weighed and sexed. Measurements are expressed in centimeters and grams. The sizes were established according to Lopez Cazorla *et al*. (2003), and represents: size 1 (S1) a maximum TL of 4.5 cm (correspond to the age 0-1), size 2 (S2) between 4.5-6 cm (to the age 1-2) and the size 3 (S3), more than 6 cm. The number of specimens, by sex, size, site and year of collection are provided in Tab. I.

Fish were examined for parasites under stereoscopic binocular microscope. The parasites were studied alive. The digeneans, cestods, and monogeneans were heat killed without pressure between slices and then preserved in 10% formaline. Acantocephalans were put in distillated water and leaved in freezer until the proboscis was everted and then preserved in 70% alcohol. Nematodes were relaxed in hot 70% alcohol. Copepods were fixed in 10% formaline. The parasites were stained and mounting according to Pritchard & Kruse (1982). The nematode, acanthocephalans and copepods were cleared with lactic acid and observed under light microscopy.

The parasitological indexes: prevalence (P), intensity (I) and mean abundance (MA) were calculated with the software WinBUGS and the terminology used according to Bush *et al*. (1997). According to Magurran (1988) were calculated the Berger Parker dominance index, the number of parasitic species (S), the number of parasites (N), the Shannon-Wiener diversity index (Shannon) and the Pielou evenness index (Pielou). The Shannon-Wiener diversity index and Pielou evenness index were calculated in WinBUGS according to the codes provided by Gollicher *et al*. (2006), the S and N were calculated with the same program.

The software WinBUGS generates 100,000 samples from the posterior distributions for each analysis after discarding the initial 10,000 samples as a "burn in". The mean and the 2.5th and 97.5th percentiles of the distribution of each parameter were calculated. This interval was used to represent a 95% Bayesian credible interval. The first year sampled was used as "prior" to the second year. A significance level (α) of 5% or less was considered significant ($p<=0.05$).

The vouchers specimens were deposited in the Helminthological Collection of Museo de La Plata, under the numbers MLP 6773 *Lecithaster confusus* Odhner, 1905; MLP 6774 metacercaria *Ascocotyle (Phagicola) diminuta* (Stunkard & Haviland, 1924); MLP 6775 metacercaria *Ascocotyle (Phagicola) angeloi* Travassos, 1928; MLP 6776 metacercaria *Ascocotyle (Phagicola) felippei* Travassos, 1929; MLP 6777 metacercaria *Ascocotyle (Phagicola) hadra* Ostrowski de Núñez, 1992; MLP 6778 metacercaria *Pygidiopsis macrostomum* Travassos, 1928, MLP 6779 metacercaria Echinostomatidae gen. sp., MLP 6780 metacercaria Hemiuridae gen. sp., MLP 6781 metacercaria *Thylodelphys* sp.; MLP 6782 *Gyrodactylus* sp.; MLP 6783 *Glossocercus* sp.; MLP 6784 *Wolffhugelia. matercula*; MLP 6785 Spirurida larvae nematode (L4) L4 Orden Spirurida; MLP 6786 *Contracaecum* sp.; MLP-Cr 26943 *Ergasilus sieboldii* Nordmann, 1832; ML-Cr 26944 *Lernaea cyprinacea*. The host voucher was deposited in the ichthyologic collection of the Museo de la Plata under the number MLP 11228.

RESULTS

The Figure 2 shows the comparison between T.L., S.L. and weight of males and females of both sites without separation in sizes. In S.R.C. the males and females are bigger than in B.B. In S.R.C. the males are significantly smaller than the females. In B.B., males and females are quite similar in the length and weight. The next comparison of the females and males were made according to their sizes (ages).

Fish studied from S.R.C. and B.B. harbored nine digeneans, one monogenean, one cestode, one acanthocephalan, two nematodes and two copepods, in total 16 parasitic species. The P., M.A. and I. of the parasites according to the host sex, sizes and site of collection are provided in the Tab. II. *Lecithaster confusus*, Met. Hemiuridae and *E. sieboldii* were found only in S.R.C. The P. in S1, S3, and males of the parasite *A. (P.) diminuta* were higher in B.B. compared with S.R.C. The P., M.A. and I. of met. *A. (P.) angeloi* in the S1 (males and females) were higher

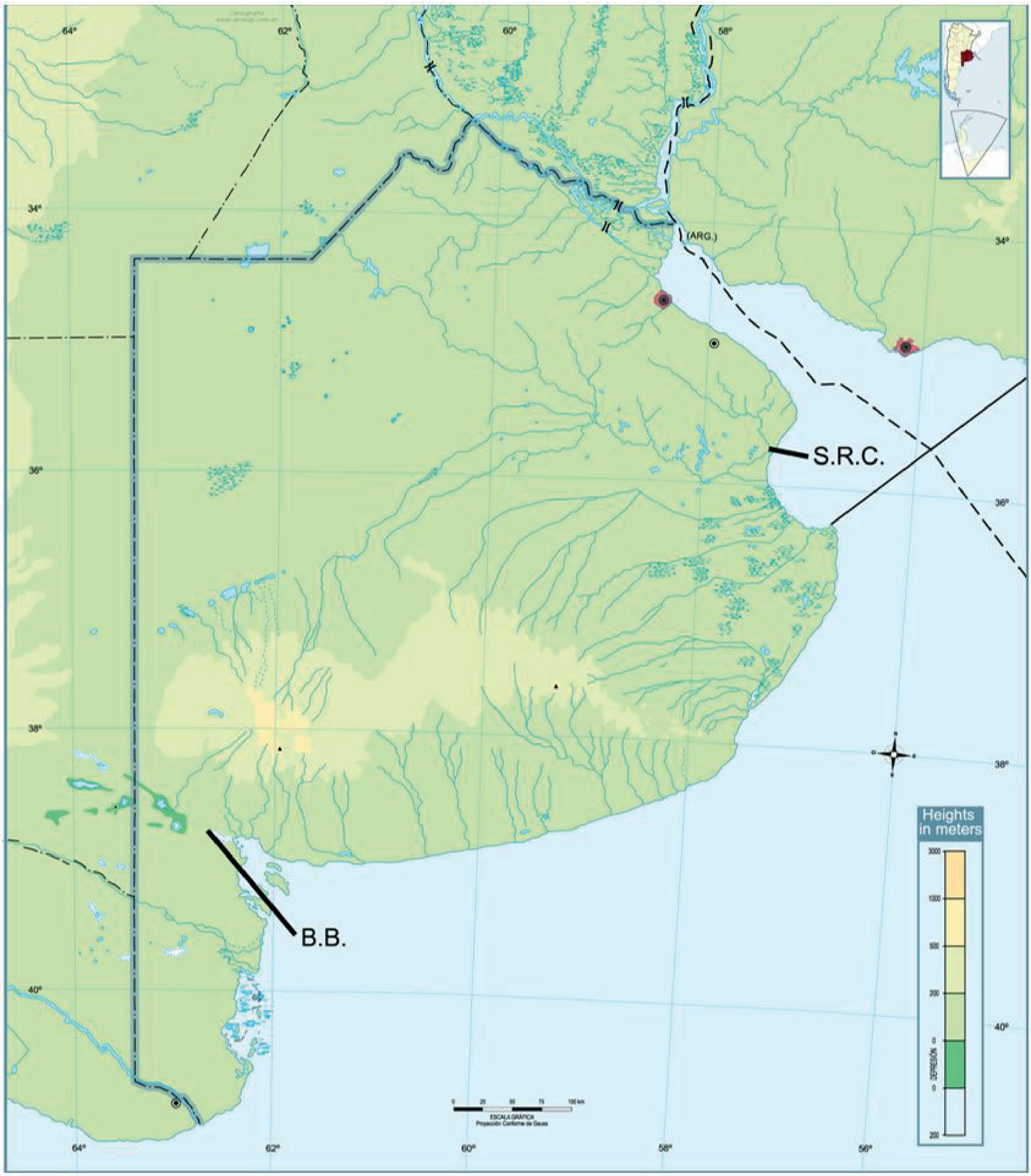

Fig. 1. Map of the sample sites, Salado Relief Channel (S.R.C.) in Samborombon Bay and the Sauce Chico River in Bahia Blanca estuary (B.B.), Argentina.

in B.B. The M.A. of the met. *A. (P.) felippei* infecting S1, was higher in B.B.; infecting S2 was higher in S.R.C.; the I. was higher in the S3 from B.B., and the P., M.A. and I. in males were higher in B.B. The P., M.A., and I. of the met. *A. (P.) hadra* were higher in the males of B.B. The P., M.A., and I of the met. *P. macrostomum* in S1 were higher in B.B.; the P., M.A., and I. infecting S3 were higher in S.R.C.; the males of the boty sites had similar P., but the M.A. and I. were higher in B.B. The P., M.A., and I of the met. Echinostomatidae infecting S1 and the males were higher in B.B.; the P., M.A., and I infecting S3 were higher in S.R.C. The P., M.A., and I. of the cestode *Glossocercus* sp. infecting S3 were higher in S.R.C. The P., M.A. and I. of the acanthocephalan *W. matercula* were higher in S.R.C.

Tab. I. Number of *Jenynsia multidentata* Jenyns, 1842 according to year, sample site, sex and size [B. B., low Sauce River of Bahia Blanca; F., females; M., males; S.R.C., Salado River Channel; S1, size 1 (T.L.< 45 mm); S2, size 2 (T.L. = 45-60 mm); S3, size 3 (T.L. > 60 mm)].

			2009	2010	Total
S.R.C.	F.	S1	48	14	62
		S2	2	10	12
		S3	0	7	7
	M.	S1	50	48	98
	Total		100	79	179
B.B.	F.	S1	29	52	81
		S2	14	6	20
		S3	4	0	4
	M.	S1	52	41	93
	Total		99	99	198
TOTAL			199	178	377

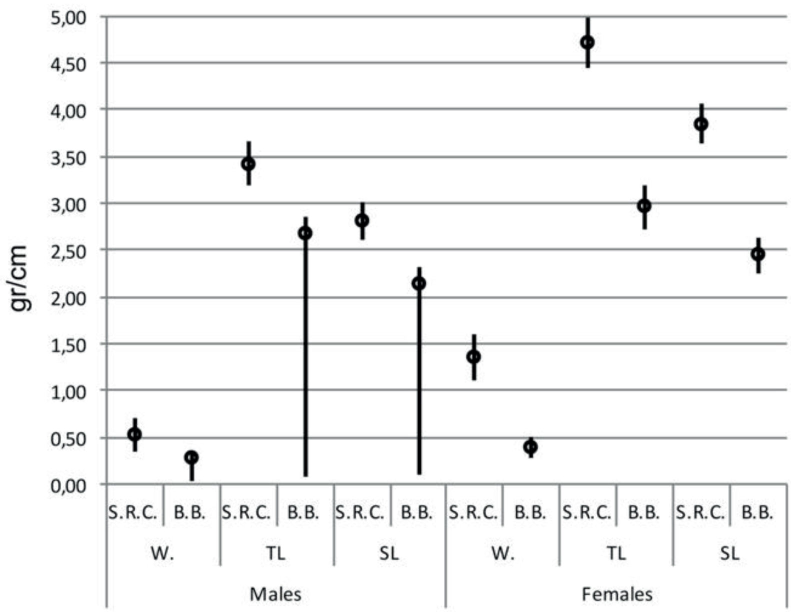

Fig. 2. Mean and the 95% credibility range of Weight (W.) in grams (gr), total and standard length (TL and SL) in centimeters of *Jenynsia multidentata* Jenyns, 1842 in Salado River Channel (S.R.C.) and Low Sauce River of Bahia Blanca (B.B.), Argentina.

The P., M.A., and I of the nematode *Contracaecum* sp. in S1, S2 and S3 were higher in B.B.

The comparison between the female body sizes of *J. multidentata* in S.R.C. showed higher I. in S2 and S3 of the parasite: *A. (P.) diminuta*, *A. (P.) felippei*, met. Echinostomatidae and *E. sieboldii*; the M.A. of the met. Echinostomatidae and Nematoda L4 was higher in the S2 and S3.

The comparison between the female body sizes of *J. multidentata* in B.B. showed a higher P., M.A., and I. of the *A. (P.) felippei* in S1 and S3 against S2. The M.A. and I. of the *Pygidiopsis macrostomum* were higher in S1; the P. of the met. Echinostomatidae was higher in S1; the P. and M.A. of the nematode L4 were higher in S3; the P. of the nematode *Contracaecum* sp. was higher in S3 compared with S1, but there was not differences when the comparison was between S2 and S3.

When the comparison was between males and females of S1 in S.R.C., we found: the M.A. of the met. Echinostomatidae was higher in the females; the P., M.A., and I. of the met. Hemiuridae were higher in the males.

The comparison between males and females of S1 in B.B. showed higher P. of *A. (P.) hadra* in the females of S1; the P. and M.A. of the met. *P. macrostomum* were higher in the females of S1; the M.A. of the nematode L4 was higher in males of S1; the P. and M.A. of the nematode *Contracaecum* sp. were higher in females of S1.

In the Tab. III could be observed the Dominance Index of Berger Parker calculated for the most abundant species according to the microhabitat in the host: intestine, musculature, branchial arch, mesentery/coelom, skin and eyes. The Dominance Index of Berger Parker in the gills were higher value for the met. Echinostomatidae and, then, the met. *A. (P.) diminuta*; in the aortic bulb was the met.

Tab. II. Microhabitat of parasite infection on the *Jenynsia multidentata* Jenyns. 1842. Prevalence, mean abundance and mean intensity infection of the parasite species according sample site, host sex and size. The mean of prevalence, abundance and intensity are followed by the credibility range in parenthesis [A.B., aortic bulb; B.B., low Sauce River of Bahia Blanca; E., eye; F., females; G., gills; I., intensity; In., intestine; M., males; M.A., mean abundance; Met., metacercariae; Mu., musculature; My., Mesentery; P., Prevalence; S., skin; S.I., site of infection; S.R.C., Salado River Channel; T.L., total length; S1, size 1 (T.L.< 45 mm); S2, size 2(T.L. = 45-60 mm); S3, size 3 (T.L. > 60 mm)].

				S.I.	P.	M.A.	I.
DIGENEA							
Lecithaster confusus Odhner, 1905	S.R.C.	F.	S1	In.	19 (3-37)	0.14 (0.11-0.35)	1
			S2		17 (0.7-37)	0.12 (0.1-0.34)	1
			S3		-	-	-
		M.	S1		3.4 (0.5-10.9)	0.02 (0.01-0.06)	1
	B.B.	F.	S1		-	-	-
			S2		-	-	-
			S3		-	-	-
		M.	S1		-	-	-
Met. *Ascocotyle* (*Phagicola*) *diminuta* (Stunkard & Haviland, 1924)	S.R.C.	F.	S1	G.	16 (7.30-24.60)	0.2 (0.02-0.38)	1.55 (1-3)
			S2		21 (3.20-42.10)	0.69 (0-2.70)	3.82 (3.77-3.88)
			S3		22 (1.10-47.60)	2.14 (0-8)	15 (14.92-15.08)
		M.	S1		14 (7.60-20.90)	0.11 (0-0.20)	1.37 (1-2.46)
	B.B.	F.	S1		58 (47.80-68.70)	0.78 (0.47-1.08)	2.14 (1.56-2.71)
			S2		59 (39-78.70)	2.03 (0.52-3.55)	3.52 (1-11.88)
			S3		83 (48-100)	8.5 (0-18.44)	8.5 (1-18.44)
		M.	S1		61 (51.40-71)	1.18 (0.77-2)	2.43 (1.78-3.09)
Met. *Ascocotyle* (*Phagicola*) *angeloi* Travassos, 1928	S.R.C.	F.	S1	Mu.	3 (0.40-8.50)	0.02 (0-0.05)	1
			S2		-	-	-
			S3		-	-	-
		M.	S1		3 (0.60-7.10)	0.02 (0-0.05)	1
	B.B.	F.	S1		38 (27.90-48.50)	0.42 (0.24-0.60)	1.72 (1.38-2.05)
			S2		-	-	-
			S3		-	-	-
		M.	S1		40 (30.30-49.80)	0.51 (0.29-0.73)	1.64 (1.18-2)
Met. *Ascocotyle* (*Phagicola*) *felippei* Travassos, 1929	S.R.C.	F.	S1	A.B.	11 (3.90-18.60)	0.02 (0.01-0.02)	1.33 (1-1.98)
			S2		17 (0.70-36.80)	0.4 (0-1)	4 (3.92-4.08)
			S3		33 (2.60-67)	0.57 (0-2)	4 (3.92-4.08)
		M.	S1		1.70 (0.20-5.50)	<<0	1
	B.B.	F.	S1		18 (8.60-28.40)	0.29 (0.07-0.52)	3.10 (1.51-4.70)
			S2		3 (0.40-7.90)	<<0	1
			S3		22 (1.10-47.60)	5 (0-10)	20 (19.92-20.00)
		M.	S1		27 (18.70-36.40)	0.31 (0.14-0.49)	1.57 (1.05-2.10)
Met. *Ascocotyle* (*Phagicola*) *hadra* Ostrowski de Núñez, 1992	S.R.C.	F.	S1	My.	14 (6.10-22.60)	0.13 (0.04-0.21)	1
			S2		29 (7.50-51.40)	0.3 (0-0.80)	1
			S3		44 (14.90-74.60)	1.14 (0-3.08)	2.67 (1-10.25)
		M.	S1		8 (3.2-13.40)	0.05 (0-0.11)	1
	B.B.	F.	S1		30 (21-33.90)	0.44 (0.14-0.73)	1.91 (1-3.13)
			S2		18 (4.10-34)	0.2 (0-0.48)	1
			S3		67 (33-97)	1.25 (0-4)	1.67 (1-5.86)
		M.	S1		44 (34.4-54.2)	0.74 (0.51-0.98)	1.75 (1.37-2.12)
Met. *Pygidiopsis macrostomum* Travassos, 1928	S.R.C.	F.	S1	My.	3.9 (11-18.6)	0.2 (0.02-0.37)	4
			S2		36 (12.7-59.9)	0.88 (0-2.09)	2 (1-5)
			S3		56 (25.4-85.1)	2.57 (0-7.49)	4.5 (1-18)
		M.	S1		12 (6-18.4)	0.16 (0.1-0.35)	5
	B.B.	F.	S1		75 (63-85.6)	5.42 (3.46-7.38)	7.18 (4.82-9.54)
			S2		25 (1.3-52.7)	0.17 (0-0.68)	1
			S3		-	-	-
		M.	S1		26 (17.7-35.2)	0.02 (0-0.06)	1

Tab. II. Cont.

				S.I.	P.	M.A.	I.
Met. Echinostomatidae	S.R.C.	F.	S1	G.	19 (0.27-37.3)	0.29 (0.22-0.71)	2
			S2		21 (3.2-42.10)	1 (1.21-3.37)	6
			S3		44 (14.9-74.6)	24.7 (26.67-76.96)	57 (1-100)
		M.	S1		11 (5.3-17.2)	0.05 (0.03-0.10)	2
	B.B.	F.	S1		67 (56.6-76.6)	0.72 (0.24-1.19)	4.56 (3-6)
			S2		14 (1.8-27.7)	0.44 (0.21-0.68)	25
			S3		-	-	-
		M.	S1		56 (45.8-65.6)	1.65 (0.37-2)	4.59 (3-6)
Met. Hemiuridae	S.R.C.	F.	S1	C.	9 (2.9-16.5)	0.08 (0-0.14)	1
			S2		17 (0.7-36.8)	0.2 (0-0.67)	2
			S3		22 (1.1-47.6)	0.50 (0.29-1.08)	2
		M.	S1		58 (48.4-67.6)	1.49 (0.93-2.05)	2.86 (2-4)
	B.B.	F.	S1		-	-	-
			S2		-	-	-
			S3		-	-	-
		M.	S1		-	-	-
Met. *Tylodelphylus* sp.	S.R.C.	F.	S1	E.	-	-	-
			S2		-	-	-
			S3		-	-	-
		M.	S1		3.4 (0.5-10.9)	0.38 (0-1.12)	18
	B.B.	F.	S1		3 (0.5-9.9)	0.02 (0-0.06)	1
			S2		25 (1.3-52.7)	0.67 (0-2.7)	4
			S3		-	-	-
		M.	S1		-	-	-
MONOGENEA							
Gyrodactylus sp.	S.R.C.	F.	S1	S.	9 (2.9-16.5)	0.06 (0-0.16)	3.45 (1-8)
			S2		17 (0.7-36.8)	0.6 (0-2)	6
			S3		-	-	-
		M.	S1		6 (0.6-12.5)	0.19 (0-0.45)	4.5 (1-10)
	B.B.	F.	S1		9 (2.4-16.7)	0.07 (0-0.14)	1
			S2		14 (1.8-27.7)	0.15 (0-0.41)	1
			S3		-	-	-
		M.	S1		4 (0.8-8.3)	<<0	1.33 (1-3)
CESTODA							
Glossocercus sp.	S.R.C.	F.	S1	My.	58 (45.8-69.7)	0.99 (0-1.49)	3.9 (1-15)
			S2		31 (10.5-53.3)	0.5 (0-1.45)	2.65 (1-10)
			S3		56 (25.4-85.1)	1 (0-2.47)	1.75 (1-5)
		M.	S1		58 (48.4-67.6)	1.49 (0.93-2.06)	2.86 (2-4)
	B.B.	F.	S1		60 (49.7-70.6)	1.54 (1.09-2)	2.33 (1-3)
			S2		38 (8-69)	4.5 (1-17)	13.5 (1-25)
			S3		-	-	-
		M.	S1		64 (54.6-73.7)	1.86 (1.34-2.38)	2.25 (2-4)
ACANTHOCEPHALA							
Wolffhugelia matercula Mañe-Garzon & Dei-Cas, 1974	S.R.C.	F.	S1	In.	11 (3.9-18.6)	0.09 (0.01-0.16)	1
			S2		17 (0.7-36.8)	0.1 (0-0.34)	1
			S3		-	-	-
		M.	S1		7 (2.4-12)	0.05 (0-0.1)	1
	B.B.	F.	S1		14 (7.2-21.8)	0.13 (0.05-0.20)	1
			S2		23 (6.9-39.9)	0.36 (0-0.72)	1.25 (1-2)
			S3		33 (2.6-67)	0.25 (0-1.35)	1
		M.	S1		11 (4.8-16.8)	0.1 (0.03-0.16)	1

Tab. II. Cont.

				S.I.	P.	M.A.	I.
NEMATODA							
Larvae 4 gen. sp. indet.	S.R.C.	F.	S1	In.	4 (2.6-8.5)	<<0	1
			S2		-	-	-
			S3		22 (1.1-47.6)	0.29 (0-1.08)	2
		M.	S1		4 (2.6-8.5)	<<0	1
	B.B.	F.	S1		4 (0.4-7.5)	<<0	1
			S2		-	-	-
			S3		50 (14.6-85.3)	1.08 (0.75-2.87)	1.5 (1-7)
		F.	S1		9 (1.8-17.9)	0.07 (0.04-0.15)	1
Contracaecum sp.	S.R.C.	F.	S1	My.	6 (1-12)	<<0	1
			S2		-	-	-
			S3		22 (1.1-47.6)	0.14 (0-0.54)	1
		M.	S1		2.7 (0.6-7.1)	<<0	1
	B.B.	F.	S1		29 (19.4-38.7)	0.44 (0.25-0.64)	1.72 (1-2)
			S2		45 (25.4-65.7)	0.51 (0.13-0.89)	1
			S3		83 (47.8-99.5)	2.75 (0-5)	2.75 (1-10)
		M.	S1		4 (0.8-8.3)	<<0	1
COPEPODA							
Ergasilus sieboldii Nordmann, 1832	S.R.C.	F.	S1	G.	8 (2-14.4)	0.07 (0-0.16)	1
			S2		17 (0.7-36.8)	0.3 (0-0.97)	3
			S3		-	-	-
		M.	S1		6 (1.9-10.7)	0.05 (0-0.09)	1
	B.B.	F.	S1		-	-	-
			S2		-	-	-
			S3		-	-	-
		M.	S1		-	-	-
Lernaea cyprinacea Linnaeus, 1758	S.R.C.	F.	S1	S.	-	-	-
			S2		25 (4-48)	0.2 (0-0.51)	1
			S3		-	-	-
		M.	S1		5 (1.4-9.8)	<<0	1
	B.B.	F.	S1		7 (1.4-14.1)	0.06 (0-0.12)	1
			S2		13 (0.5-41)	<<0	1
			S3		-	-	-
		M.	S1		4 (0.8-7.9)	0.04 (0-0.08)	2 (1-5)

A. (P.) felippei; in the mesentery were met. *P. macrostomum* and *Contracaecum* sp.; in the intestine was the acanthocephalan *W. matercula*; in the musculature was the met. *A. (P.) angeloi*; in the skin was the monogenean *Gyrodactylus* sp. and in the eye was the met. *Thylodephylus* sp.

The infracommunity and component community indexes are provided in Tab. IV. The comparison between samples sites showed higher Shannon-Wiener diversity index and Pielou evenness index in the females S1, S2 and males from S.R.C. against B.B.; the females of S3 and the males from B.B. had higher number of parasitic species against S.R.C. The males of B.B., compared with the females of the same sample site, had higher Shannon and Pielou indexes.

The Shannon and Pielou indexes showed similar pattern when was compared the different sizes of females in the same sample site. The higher values correspond to the S2, then S1 and last the S3. The number of parasitic species was similar between S1-S2, and S1-S3, but higher in S3 compared with S2.

Tab. III. Berger Parker indexes of the parasites according to the microhabitat and size of *Jenynsia multidentata* Jenyns, 1842, and simple site [A.B., aortic bulb; B.B., low Sauce River of Bahia Blanca; F., female; E., eye; G., gills; H.S., host sex; I., intestine; M, male; Mu., musculature; My., mesentery; S., skin; S.I., site of infection; S.R.C., Salado River Channel; S.S., sample site; T.L., total length; S1, size 1 (T.L.< 45 mm); S2, size 2 (T.L. = 45-60 mm); S3, size 3 (T.L. > 60 mm)].

	S.I.	H.S.	S.S.	S1	S2	S3	Total
Met. *Ascocotyle* (*Phagicola*) *diminuta* (Stunkard & Haviland, 1924)	G.	F.	S.R.C.	18.56	7.09	7.00	7.94
			B.B.	7.31	43.01	71.00	17.98
		M.	S.R.C.	11.79			
			B.B.	12.24			
Met. Echinostomidae gen. sp. indet.	G.	F.	S.R.C.	2.90	10.79	75.22	26.79
			B.B.	35.96	13.17		32.46
		M.	S.R.C.	5.49			
			B.B.	38.18			
Met. of *Ascocotyle (Phagicola) felippei* Travassos, 1929	A.B.	F.	S.R.C.	1.68	3.70		2.38
			B.B.	9.03	1.88		6.41
		M.	S.R.C.	0.20			
			B.B.	4.88			
Met. of *Pygidiopsis macrostomum* Travassos, 1928	My.	F.	S.R.C.	4.79	8.94	3.91	5.95
			B.B.	7.73	10.22		7.99
		M.	S.R.C.	12.41			
			B.B.	5.47			
Contracaecum sp.	My.	F.	S.R.C.	0.63		0.22	0.61
			B.B.	5.96	15.75	11.46	8.53
		M.	S.R.C.	0.39			
			B.B.	6.32			
Wolffhugelia matercula Mañé-Garzón & Dei-Cas, 1974	I.	F.	S.R.C.	3.01	0.93		1.19
			B.B.	2.65	0.27		1.86
		M.	S.R.C.	1.21			
			B.B.	1.20			
Met. *Ascocotyle* (*Phagicola*) *angeloi* Travassos, 1928	Mu.	F.	S.R.C.	0.21			0.16
			B.B.	12.50			8.73
		M.	S.R.C.	0.40			
			B.B.	4.75			
Gyrodactylus sp.	S.	F.	S.R.C.	15.12	5.56		4.15
			B.B.	0.63	0.54		0.50
		M.	S.R.C.	1.84			
			B.B.	0.54			
Met. *Thylodephylus* sp.	E.	F.	S.R.C.				
			B.B.	0.03	1.08		
		M.	S.R.C.	3.67			
			B.B.				

DISCUSSION

The great number of parasitic larval stages found in the examined fishes, and the high dominance observed in, mainly, all the microhabitats, seem to indicate that it possible that this fish is used as the food item for others vertebrates species (mainly birds) were the adult stage of those parasites could be found. As result of this, the one-side livebearers could be a link in the flow of energy inside the food chain, and its parasites used as biological tags .

The high prevalence, mean abundance and intensity of parasites in B.B. are the consequence of a rise the rate meeting between parasite and host due the size of water body (B.B. is smaller than S.R.C.). Also, exist the question "The chemical contaminants and environmental impacts of both sites are similar?". Even though this issue was not addressed in this paper, Schenone *et al*. (2007) found several contaminants in the Lower Salado River (S.R.C), like Cr, Pb, Cu, and Zn; but in Sauce Chico (B.B.), Rosso *et al*. (2011) found low anthropogenic contamination. According with

Tab. IV. The infracommunity indexes [number of parasitic species (S), number of parasite (N), and the component community index Shannon-Wiener index of biodiversity (Shannon) and Equitability index of Pielou] calculated with Bayesian statistics according to the simple site, host sex and size. The mean are followed by the credibility range in parenthesis [B.B., low Sauce River of Bahia Blanca; F., females; M., males; S.R.C., Salado River Channel; T.L., total length; S1, size 1 (T.L.< 45 mm); S2, size 2 (T.L. = 45-60 mm); S3, size 3 (T.L.> 60 mm). In parenthesis are the 95% credibility limits.

			Infracommunity indexes		Component Community indexes	
			S	N	Shannon	Pielou
S.R.C.	F.	S1	2.99 (2.38-3.6)	7 (5-9)	1.69 (1.49-1.88)	0.61 (0.54-0.68)
		S2	3.7 (0-11)	14 (1-60)	2.24 (2.07-2.42)	0.81 (0.74-0.87)
		S3	2.17 (1.44-2.9)	32.86 (1-85)	0.88 (0.59-1.16)	0.32 (0.21-0.42)
	M.	S1	2.17 (1.44-2.9)	8 (5-12)	1.93 (1.83-2.03)	0.7 (0.66-0.73)
		S2	-	-	-	-
		S3	-	-	-	-
B.B.	F.	S1	2.47 (1.21-3.73)	11 (6-15)	1.31 (1.26-1.37)	0.47 (0.45-0.5)
		S2	1.38 (0.43-2.34)	3 (1-6)	1.92 (1.79-2.04)	0.69 (0.65-0.74)
		S3	3.5 (3-4)	7 (5-10)	1.03 (0.86-1.21)	0.37 (0.31-0.44)
	M.	S1	3.5 (3-4)	7 (5-9)	1.49 (1.43-1.56)	0.54 (0.52-0.56)
		S2	-	-	-	-
		S3	-	-	-	-

these records could be assumed that high prevalences and mean abundances of parasite in B.B. could be relationed with the less contaminant concentration in the environment or a combination of factors. The differences observed between sites in the P., M.A., and I. in the S3 could be a consequence a little number of host revised, only seven in S.R.C. and four in B.B.

Lecithasther confusus parasiziting *J. multidentata* is a *new host and locality* records. The Hemiuridae and *Thylodelphys* metacercariae (inside the vitreous humor), *Glossocercus* sp., nematode L4 (intestine) and de *E. sieboldii* are all new host records. The presence of *L. confusus*, metacercariae Hemiuridae g. sp. and *E. sieboldii* could be explained by the alternation of saline and freshwater in the S.R.C. allowing the development of a wide range of host organisms. Samples sites are connected with the respective estuaries and the fishes could go to more-saline waters, despite this, the sample site on Sauce Chico is far from the mouth of the channel, but in the S.R.C. fish were collected near to the Bahia Samborombón. The number of parasite species in each site (regardless size or gender of the host) is greater in S.R.C. (16 vs. 13 species) this could be, also, for the daily flow of salt water from the bay while in the Sauce Chico River freshwater predominates. The larvae nematode (L4) was not found in the S2 of both environments. Perhaps, the nematode found in host of S1 and S3 are different species and used different foods items as host. According to Quintans *et al*. (2009), there is a change in the alimentary items of this fishes according to the size. *Jenynsia multidentata* change when grow up, the zooplankton for the periphyton items and (when to be available) insects and crustaceans. That change in the prey items is a consequence of the mouth ontogeny (Guma'a, 1978; Mills *et al*., 1985; Lazzaro, 1987).

The differences observed between males and females could be as a result to differences in the alimentation or parasite susceptibility.

Digenean metacercariae are the most diverse and dominant species in *J. multidentata* of both sites, showing that in the environment live the intermediate hosts necessary to accomplish the life cycle of the parasites.

The difference in the Shannon-Wiener diversity index and Pielou equitability index observed between female sizes in both sites have a similar pattern: higher in S2, then S1 and last S3. The S2 represent fish of two years old, the infective parasite larva had more time to find the host and with that an increase on the equitability among the parasite species is observed. Also, the high microhabitats available in the *J. multidentata* make very low the competition between species. In S1 the fish are young so, they have a little time of exposure to be infected with many species and when the infection is accomplished the number of parasites that success is low. The S3 represent older fish and represent the survivors of S2. These fishes have a little diversity of parasites with high abundance, that reduces the Shannon and Pielou index. The specimens of S2 with more parasites died before reach the S3, this could be proved because the number of host of this size are very low.

When analyzes the community indexes between sites is evident a high Pielou equitability index from S.R.C. These could be, as we expose, due to an alternation of saline and freshwater in the S.R.C. that allows a high diversity of species and making none more dominant.

This is the first approximation to an analysis of the parasitic ecology on *Jenynsia multidentata*. The parasite fauna of this host could report important information and should be analyzed as indicator of biodiversity, food chain and contamination. Also, could be used the population of a parasite specie as an environment sentinel. On the other hands, some of this parasite could represents a risk for human health like the metacercariae *Pygidiopsis* sp. with reports parasitizing humans (Chai & Lee, 2002).

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